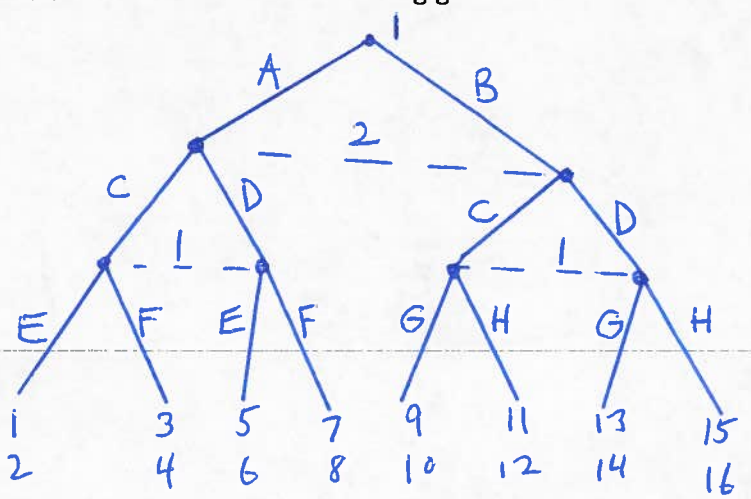
Your Name: _____

The Ohio State University
Department of Economics
Econ 5001 Midterm Examination, Spring 2015
Prof. James Peck

**Directions:** *For questions 1-7, neatly circle or otherwise indicate the correct choice. To receive credit on problem 8, show all work and continue to the next page if necessary.*

Questions 1 and 2 refer to the following game tree:




**1. (5 points)** *How many different pure strategies does player 1 have in this game?*

(a) 2
(b) 3
(c) 6
(d) 8
(e) 16

**2. (5 points)** *How many different pure strategy profiles are there in this game?*

(f) 8
(g) 10
(h) 12
(i) 16
(j) 32

Questions 3, 4, and 5 refer to the following game in matrix form:

| | | player 2 | | | |
|---|---|---|---|---|---|
| | | W | X | Y | Z |
| player 1 | A | 3,2 | 1,1 | 4,3 | 3,5 |
| | B | 1,3 | 3,0 | 2,4 | 4,2 |
| | C | 2,1 | 0,1 | 1,2 | 1,0 |
| | D | 1,0 | 2,0 | 3,1 | 4,0 |

**3. (10 points)** *What are player 2's best responses to the belief that player 1 plays A with probability one half and C with probability one half?*

(k) A is player 2's only best response.
(l) Y is player 2's only best response.
(m) Z is player 2's only best response.
(n) Y and Z are both best responses.
(o) none of the above.

**4. (10 points)** *Which of the following statements are true?*

(p) A dominates C, Ydominates W, and B dominates D.
(q) A dominates C, W dominates X, and Y dominates X.
(r) A dominates C, Y dominates W, and Y dominates X.
(s) A dominates C, Y dominates Z, and B dominates D.
(t) A pure strategy cannot be dominated by another pure strategy.

**5. (15 points)** *Which profile of mixed strategies is a mixed strategy Nash equilibrium?* Note: Read player 1's strategies from top to bottom and player 2's strategies from left to right. That is, $\sigma_1 = (\sigma_1(A), \sigma_1(B), \sigma_1(C), \sigma_1(D))$ and $\sigma_2 = (\sigma_1(W), \sigma_1(X), \sigma_1(Y), \sigma_1(Z))$.

(a) $\sigma_1 = (\frac{2}{3}, \frac{1}{3}, 0, 0)$ and $\sigma_2 = (\frac{1}{2}, \frac{1}{2}, 0, 0)$.
(b) $\sigma_1 = (\frac{1}{3}, \frac{1}{3}, \frac{1}{3}, 0)$ and $\sigma_2 = (0, 0, \frac{1}{2}, \frac{1}{2})$.
(c) $\sigma_1 = (\frac{1}{2}, \frac{1}{2}, 0, 0)$ and $\sigma_2 = (0, 0, \frac{1}{3}, \frac{2}{3})$.
(d) $\sigma_1 = (\frac{1}{3}, 0, 0, \frac{2}{3})$ and $\sigma_2 = (0, 0, \frac{1}{2}, \frac{1}{2})$.
(e) $\sigma_1 = (\frac{1}{2}, 0, 0, \frac{1}{2})$ and $\sigma_2 = (0, 0, \frac{1}{2}, \frac{1}{2})$.

Questions 6 and 7 refer to the following game in matrix form:

| | | player 2 | | | | | |
|---|---|---|---|---|---|---|---|
| | | K | L | M | N | O | P |
| player 1 | AA | 2,0 | 2,1 | 3,2 | 0,0 | 0,0 | 0,0 |
| | BB | 3,1 | 4,4 | 1,2 | 0,0 | 0,0 | 0,0 |
| | CC | 5,4 | 1,5 | 2,5 | 0,0 | 0,0 | 0,0 |
| | DD | 0,0 | 0,0 | 0,0 | 2,2 | 1,1 | 2,1 |
| | EE | 0,0 | 0,0 | 0,0 | 1,7 | 0,8 | 1,9 |
| | FF | 0,0 | 0,0 | 0,0 | 1,1 | 0,9 | 7,0 |

**6. (10 points)** *Which of the following strategy profiles is NOT a Nash equilibrium?*

(f) (AA,M)
(g) (BB,L)
(h) (CC,K)
(i) (DD,N)
(j) All of the above are Nash equilibria.

**7. (15 points)** *Which of the following strategies for player 2 is NOT rationalizable?*

(v) L
(w) M
(x) N
(y) O
(z) All of player 2's strategies are rationalizable.

**8. (30 points)**

Two firms are playing a game of Cournot (quantity) competition. Denoting the quantity chosen by firm 1 as $q_1$ and the quantity chosen by firm 2 as $q_2$, the market price is given by the inverse demand equation

$$p = 100 - q_1 - q_2.$$

The firms' cost functions exhibit increasing marginal costs, where a firm's cost is the square of its output. That is, for $i = 1, 2$, firm $i$'s cost of producing $q_i$ units of output is $(q_i)^2$. Each firm's payoff is defined to be its profit.

*(a) (10 points) Find the best-response functions of each firm.*
*(b) (15 points) Find the Nash equilibrium strategy profile for this game.*
*(c) (5 points) Find the profits received by each firm at the Nash equilibrium.*